

Nova Scotia (Pictou County), Prince Edward Island, Maine (Aroostook, Pisquataquis, Hancock Counties), New Hampshire (White Mountains), Vermont (Lamoille, Orleans Counties), New York (Essex County), Michigan (St. Clair, Genesee, Chippewa, Houghton, Keweenaw Counties), Minnesota (Millelacs, Aitkin Counties). From British Columbia I have only seen two specimens, one collected by J. Macoun under 54, Telegraph Trail, June 18, 1875 (No. 1666, f.; G.) and the other by J. M. Macoun, Nacho (? Nazko) River, in swamps, June 18, 1875 (No. 24254, f.; O.). Both specimens need further study, but possibly *S. pyrifolia* will be found in more places between Lake Winnipeg, the Great Slave Lake and northern British Columbia.

I refer to sect. *Balsamiferae* not without a good deal of doubt, also the following species which on the other hand shows some relationship to the *Commutatae*.

S. obtusata Fernald in *Rhodora* ix. 223 (1907). — This remarkable species is so far only known from the Gaspé Peninsula. The type has been collected by Fernald & Collins on innundated gravelly bars and beaches, River St. Anne des Monts, near the head of the Grand Rapids, July 15, 1906 (No. 203, fr.) and August 16, 1906 (No. 203^a, st.), and by Williams and Fernald in Bonaventure County, New Carlisle, Arborvitae swamp, July 28, 1902 (st.; Cor.; 0.9 to 1.2 m. high). The last specimen apparently belongs to this species, but it has no stipules which are rather large and persistent in the type.

According to Fernald "the leaves are glabrous, or the youngest arachnoid-tomentose," but I have been unable to find a trace of an arachnoid pubescence on them. The following description seems to me more correct: *folia novella superne paullo (praesertim ad costam) puberula, demum costa basi pilosula excepta glabra, subtus ab initio glaberrima.* Fernald says: "Closely allied to and strongly simulating the Siberian *S. pyrolae-folia* Ledeb., but differing in its more shallowly toothed leaves, shorter sessile aments and very short styles." I am by no means convinced, however, that the Siberian species is closely related to *S. obtusata* of which much more copious material is needed to decide the question of its true relationship.

VIENNA, November, 1919.

THE LIUKIU ISLANDS AND THEIR LIGNEOUS VEGETATION

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THE Liukiu Archipelago is a group of small islands between Lat. 28°, 30' and 24° N. which like a string of stepping stones connect south Japan with Formosa. It is divisible into three lesser groups, a northern, the Oshima group, a central, the Okinawa group, and a southern, the Sakishima group. All the islands are washed by the warm Japan current and enjoy an equi-

table, warm-temperate climate. The Oshima group is the most rugged; and it has the heaviest rainfall in the whole of the Japanese Empire, the average annual precipitation being 3300 mm. The Sakishima group I had no opportunity of visiting, but from photographs I gather that the vegetation is subtropical in character. The central is the largest and most important of the three groups, Okinawa, the main island, being 268 miles in circumference and 98 miles from north to south. The chief seaport is Naha, situated in the southwest corner of the island. A few miles inland from Naha is the town of Shuri, formerly the seat of government of the native kings.

The Liukiu people are mild and inoffensive and are a distinct race, probably of Malay origin. At one time independent, they succumbed to Chinese invaders and afterwards owed dual allegiance to China and Japan. In 1879 the islands passed definitely to Japan; the native king was removed to Tokyo and later given the rank of Marquis. As a race the Liukiu people are smaller than the Japanese and their manners and customs are primitive. The women, in particular, work hard and carry all loads on their heads. Children abound. The houses are very small, one-storied, constructed of bamboo-wattle sides and thatched roofs. Each is enclosed by a wall or fence, the people apparently being fond of privacy. Unlike the houses the graves are enormous and exceed in size even those of the Chinese. It would appear that all the wealth of the people is lavished on the building of tombs in rock and masonry — huge, imposing horse-shoe shaped, conspicuous structures.

Part farmer, part fisherman best describes the Liukiu man and in the latter capacity he excels. In farming he depends largely on his women. Rice, sweet potatoes, and sugar-cane are the chief crops. Of rice, two crops are obtained annually, the first being planted about the end of February. The Japanese have introduced new methods and new industries; the education of the children has been taken in hand and much is being done toward the improvement of the conditions and social life of the Liukiu people.

For several centuries prior to the formal annexation of the Liukiu Islands by Japan the powerful feudal lords of the Satsuma had exercised a strong influence over the islands. That the connection has been close is shown by the number of Liukiu plants cultivated round Kagoshima from long ago. The Sweet Potato, known generally in Japan as the "Satsuma-imo," is in the neighborhood of Kagoshima called "Liukiu-imo" indicative of its origin. The Bamboo which yields edible shoots (*Phyllostachys mitis* Riv.) and now widely planted in Japan is of similar origin. In the garden behind Prince Shimazu's home in Kagoshima, there is a grove of this Bamboo and a stone tablet in its midst records the fact that the original plants were in 1726 brought from Liukiu by the Prince's ancestor. Neither the Bamboo nor the Sweet Potato are indigenous in Liukiu and probably came first from China. A favorite garden shrub in and around Kagoshima and now wide-spread in the warmer parts of Japan is *Rhododendron sub-lanceolatum* Miq., an endemic Liukiu species. The common *Cycas re-*

voluta Thunb. and the familiar *Lilium longiflorum* Thunb. are other Liukiu plants which from Japan have been widely distributed over the world.

Naha, the chief port of Okinawa Island, is reached by steamer from Kagoshima from which it is distant 415 miles. The steamers ply weekly but they are small and the passage is seldom a pleasant one. The journey is past the islands of Tanega and Yaku and the group islets, mostly uninhabited, known as the Kawanabe Islands which are strung out toward Oshima, the most northern of the Liukius proper. The island of Yaku is important phytogeographically as representing generally the southern limit of the Japanese flora. The Kawanabe Islands are all small and have very little vegetation but such as it is belongs in character to the Liukiu group. The chief port of Oshima is Naze which is favored with a small, safe anchorage. On the journey down I had opportunity to spend a few hours ashore there and was able to collect a number of plants.

Oshima is a bold, mountainous island with a rugged coast line. The highest peak is Yuwan-dake 865 m. above sea-level. From the sea the mountain slopes appear to be well-forested, chiefly with Pine. Okinawa has a much-indented coast line. The northern half of the island is decidedly mountainous, though the highest peak does not exceed 500 metres; the southern half is undulating. Geologically Okinawa is largely composed of coral rock, with granite trap ejected here and there by submarine volcanic action. The Karama Islands west of Okinawa are mainly of volcanic origin and on one of them copper is mined. The vegetation of all the islands is essentially evergreen, the scenery is pleasing and I do not think I have visited a prettier land. On Okinawa, Palm and Pine meet and the effect is striking. On Aharen Island in the Karama group, *Juniperus conferta* Parl. clothes the sandy foreshore at and above tide-mark, with it grows *Pandanus tectorius* Soland., *Hernandia peltata* Meisn. and on the rising slope behind *Hibiscus tiliaceus* L., *Livistona chinensis* R. Br. and *Pinus luchuensis* Mayr. with *Didymosperma Engleri* Warb. and *Asplenium nidus* var. *intermedia* Mett. as undergrowth. Nowhere else in the Orient is such a curious mixture of woody plants to be found.

The flora of the Liukiu Islands is not properly known. Japanese botanists have described quite a number of plants from these islands, but the references are much scattered and considerable work remains to be done. The first plants collected on the islands were gathered by the officers of the English war-ships, commanded by Captain Basil Hall, who visited the islands in 1816. These specimens were subsequently lost at sea. The next specimens were those gathered on Captain Beechey's voyage and described by Hooker & Arnott who enumerate forty-one species of woody plants. Since Beechey's voyage a number of small collections have been made but Liukiu plants are today rare in western herbaria. The particular object of my visit was to study the species of Pine and Juniper known to grow there and incidentally to collect as many dried specimens as possible. In all I spent about three weeks in Okinawa and gathered 150 species of woody plants.

In general the ligneous vegetation of the Liukiu Archipelago consists of a littoral fringe of plants wide-spread in warm-temperate and sub-tropical regions. On the mountains are found a comparatively small number of Japanese and a considerable number of endemic species. Evergreen, mostly shining foliage, is a marked feature of the vegetation. The presence of Mangrove-like trees and the endemic *Cycas revoluta* Thunb. and *Pinus luchuensis* Mayr are the three plants which give character to the vegetation.

The Pine is the commonest tree on the islands from sea-level to high up on the mountain, and is not only wild but has been abundantly planted. Here and there, and especially on the highways leading from the old capital of Shuri, some fine avenues of it may be seen. It is one of the most beautiful of Asiatic Pines and is a very distinct and easily recognized species. The bark is always gray, quite smooth on young trees, early becoming scaly and finally deeply fissured and cracked into plates of irregular size and shape. The winter-buds are reddish; the cone is chocolate-brown, small and not very persistent; the foliage is blackish green. At its best the Liukiu Pine is a handsome tree fully a hundred feet tall with a straight trunk some ten feet in girth and a crown of rather irregular shape often flattened on top. The wood is of fair quality and is very resinous. The trunk hollowed out forms the canoe which is commonly used by the fishermen. The Pine forms pure woods with usually a dense undergrowth of evergreen shrubs and low trees among which Tree Ferns, Palms, and *Cycas revoluta* Thunb. are conspicuous. This Pine, which was first recognized by H. Mayr in 1891, grows also on the small islands of the Kawanabe group south of Yakushima but is not known elsewhere. It is a singular fact that so distinct a species should have such a limited distribution. The only other Conifer indigenous in the Liukiu Islands is *Juniperus conferta* Parl., a maritime species, that has a most remarkable geographical range. The Liukius represent the southern limit of its range and it is found northward on the coasts to the shores of the Okhotsk Sea, ranging in all over twenty-three degrees of latitude. Its centre of distribution is probably Idzu Oshima, and the Boshu peninsula on the east coast of central Japan and doubtless migratory wild fowl have carried it north and south, possibly the Japan stream has also played a part in its distribution. This littoral Juniper forms, on sandy strands and rocks, at and above tide-mark, low mats often acres in extent. The color of the foliage is pea-green and the leading shoots are red-brown; the ripe fruit is subglobose, flattened at the base, plum-colored and slightly pruinose. It remains for a long time on the plant and I noticed seeds germinating while the fruit was still attached. It grows on several of the islands of the Karama group and also in Yagaji Island some forty miles north of Naha. It is essentially a sand-loving plant and in western lands should have great value as a ground cover in sea-shore gardens and on sand-dunes.

The well-known *Cycas revoluta* Thunb. is a feature everywhere in Okinawa and Oshima and also grows on the Kawanabe Islands. It is spontaneous

on coral rocks and cliffs near the sea and is a common undergrowth in Pine woods. Also it has been much planted and in times of food scarcity starch obtained from the stems was formerly a common article of diet. The plants are from one to eight feet tall and have many stems and short leaves which are cut, dried and used as fuel in the native houses and in the process of boiling sugar at the native mills. The Japanese name for this plant is "Sotetsu," which signifies "never die," and aptly describes its hardness and power of recovering from harsh treatment. From a distance it has a very black appearance and being extraordinarily abundant is a most conspicuous feature of the vegetation.

On Yagaji, a small island on the west coast some forty miles north of Naha, there is a swamp covered with Mangrove-like trees — the only one known in the Okinawa group. The width is inconsiderable and the length about a mile. It is composed of *Bruguiera gymnorrhiza* Lam. and *Kandelia Rheedii* Wight & Arn. — bushy trees from 6–10 ft. high, growing thickly together. At low tide it is possible to scramble through the swamp but knobby growths everywhere obtrude from the roots and make walking difficult.

Round the coast *Pandanus tectorius* Soland. is an ubiquitous pest. It makes an impenetrable hedge and the leaves are used by the Liukiu people in making hats and basketware. An Agave, considered by Japanese botanists *A. rigida* Miller, but probably *A. fourcroydes* Lem., has become naturalized, and has spread rapidly round the coast, and where it grows with the Pandanus there is no passing.

The wide-spread *Scaevola Koenigii* Vahl with its pale green, fleshy leaves, its small, lipped flowers in axillary cymes and white fruits is abundant and forms a broad shrub often 10 feet high. Much more ornamental is *Myoporum bontioides* A. Gray, a rare plant in Liukiu except on Yagaji Island. This is a large shrub, from 6 to 10 feet high and more in diameter, with dull green, rather fleshy leaves and blue-purple to white, axillary, tubular flowers each an inch long. In foliage and flower it is an attractive plant. The interesting *Tournefortia argentea* L. also grows on Liukiu but is rare. With these littoral shrubs and on sand and shingle often covered at high tide grows *Cassytha filiformis* L., and *Ipomaea biloba* L. The first-named with its golden-yellow leafless stems forms a regular net and the *Ipomaea* trails long distances, rooting at every node — I measured one stem carefully; it was 110 feet long!

Of Palms which with the littoral shrubs above mentioned give a tropical aspect to the vegetation only two species are indigenous. The most common is *Didymosperma Engleri* Warb. which is plentiful as undergrowth in woods and thickets near the sea. It grows from 8 to 10 feet tall, has several stems and pinnate leaves from 4 to 6 feet in length; the petiole and stem is cased in strong, coarse blackish fibres. The fruit borne in large panicles, is spheroid, slightly 3-angled, orange-colored and subtended by the colored calyx which is blackish at the base. This species also grows in Formosa. The other Palm is *Livistona chinensis* R. Br. and this is very rare on Okinawa

Island, but abundant on some of the Karama group — Aharen Island for example. With its mop-like crown of gray-green leaves over-topping the other vegetation this Palm is conspicuous from a distance; it is often associated with the Liukiu Pine. Three other Palms (*Trachycarpus excelsus* Wendl., *Rhapis flabelliformis* Aiton, and *Cyphokentia Savoryana* Rehd. & Wils.) are occasionally cultivated. The presence of a few old trees of the *Cyphokentia*, an endemic Bonin species, shows that there has been intercourse in the past between the two groups of islands.

Of broad-leaf trees quite a number grow at sea-level and a majority are wide-spread in sub-equatorial regions of the Old World. The most common are *Terminalia Catappa* L., *Calophyllum inophyllum* L., *Hernandia peltata* Meisn., *Erythrina indica* Lam., *Bischofia javanica* Bl., *Thespesia populnea* Soland., *Ficus Wightiana* Wall., *F. retusa* var. *nitida* Miq., *Melia Azedarach* L., *Hibiscus tiliaceus* var. *hamabo* Maxim., *Garcinia spicata* Hook., *Ehretia acuminata* R. Br., *Maba burifolia* Pers., *Pongamia glabra* Vent. and *Celtis liukiuensis* Nakai. The *Garcinia*, with its large leathery black-green leaves, is a very distinct looking tree and much used by the people for planting round their dwellings. The *Ficus retusa* var. *nitida* Miq. might well be termed the Liukiu Banyan. Shading houses and by bridges some picturesque old specimens are often seen with crooked stems and pendent matlike masses of aerial roots. The *Celtis* is closely related to *Celtis sinensis* Pers. and grows to a very large size. In the old palace grounds at Shuri grow some magnificent old trees of this *Celtis* and also of the *Bischofia*, *Terminalia* and *Erythrina*. As a street tree in Naha the Formosan *Acacia confusa* Merrill has been much planted. Coarse grasses belonging to the genus *Miscanthus* are common at low altitudes, especially beside streams and with a tangle of shrubs and climbers make a veritable jungle. Another herb worthy of mention is the familiar Easter Lily (*Lilium longiflorum* Thunb.) which is indigenous and grows in pockets in the coral rocks near the sea. Forms with green and purplish brown stems grow side by side.

On the mountain slopes the flora is quite different from that of the low-level areas. Nearly every tree and shrub is evergreen and shining leaves are a feature. The species are largely endemic but the whole aspect is strongly suggestive of the flora of Yakushima and south Kynshu in general.

Two Taxads (*Podocarpus macrophyllus* D. Don and *P. nagi* Zoll. & Moritzi) grow wild on the wooded mountain-slopes. Trees of both are rare owing to their wood being highly valued for construction purposes.

Lauraceae are prominent and most of them grow also in Japan. *Symplocos*, *Ilex* and *Eurya* each with several species are among the most common shrubs. In gulleys and along the side of streams the vegetation is rampant and many Ferns, including such tree forms as *Cyathea spinulosa* Wall. luxuriate. A Banana (*Musa sapientum* var. *liukiuensis* Matsum.) grows wild in moist ravines and is also cultivated for its fibre. The Japanese *Castanopsis cuspidata* Schottky is a conspicuous feature and with *Lithocar-*

pus edulis Rehd., the endemic *Quercus Miyagii* Koidz., a species resembling *Q. salicina* Bl. but with a larger and different fruit, and *Q. yayeyamensis* Koidz. are the sole representatives of Fagaceae on the Liukiu Islands. No Willow, Alder, Birch nor *Carpinus* grow there, in fact the familiar types of trees which make up the northern forests are all absent. Tree Figs are numerous, indeed. *Ficus* is the genus richest in species of trees. Both Saxifragaceae and Rosaceae are poorly represented, as is Leguminosae, but genera of Euphorbiaceae are numerous.

On Aka Island in the Karama group grows the handsome large-leaved Liukiu Box (*Buxus liukiuensis* Mak.). It is often a tree 20 ft. tall with a trunk 3 ft. in girth, and a much branched rounded or flattened crown.

An Orange with small, loose-skinned fruit (*Citrus nobilis* var. *spontanea* Ito & Matsum.) is one of the most interesting Liukiu trees. I saw none that could be considered unquestionably wild but I have no reason to question that it is endemic. It is often cultivated and grows full 12 metres tall forming a bushy crown; the fruit is bitter but of passable flavor. The red-flowered *Thea japonica* Nois is a rare plant on Okinawa, but the endemic *T. lutchuensis* Ito with its small white flowers is a common shrub. Of Ericaceae there are few, but this is not surprising when it is remembered that the rocks are mostly coral. On Mt. Genka some 45 miles north of Naha I found the pink-flowered *Rhododendron Tashiroi* Maxim., and in a thicket nearer the sea *R. sub lanceolatum* Miq. The last named, with its very large scarlet flowers, has been long cultivated in south Japan but is endemic on the Liukiu Islands. The small-flowered *R. serpyllifolium* Miq. is reported from Okinawa and with *Vaccinium bracteatum* var. *Wrightii* Rehd. & Wils., a common plant, completes the list. The black-fruited *Ardisia Sieboldii* is abundant, more usually as a large shrub than a small tree. Rubiaceae is well represented but none of the species are particularly noteworthy. Of the three species of *Viburnum* that grow on Liukiu the endemic *V. suspensum* Lindl., better known as *V. sandankwa* Hassk., is the most interesting, as its real home has only recently become known though long cultivated in Japan.

The following is a list, complete as far as my researches go, of the woody plants known from the three groups of islands which make up the Liukiu Archipelago. The flora of the northern (Oshima) group is naturally most closely related to that of south Japan and especially to that of the islands of Yaku and Tanega. The southern (Sakishima) group is rich in sub-tropical elements and is related to that of south Formosa: the central (Okinawa) group is richest in endemic plants. Analysis of the list shows that 351 species and 23 varieties belonging to 233 genera representing 87 families have been recorded. Of these two genera, *Tashiroea* and *Tetraplasia*, respectively belonging to Melastomaceae and Rubiaceae, together with seventy-one species and six varieties and forms are endemic. Round the coast cosmopolitan warm-temperate and sub-tropical elements abound, but on the mountains the flora is largely of endemic species. Its outstanding feature is its evergreen character, all but 12 of the endemic plants being

of this nature. The affinity of the flora is of course with the adjacent warm-temperate regions of south Japan, eastern China and Formosa.

Species marked with an asterisk are endemic.

- CYCADACEAE
- **Cycas revoluta* Thunb.
- TAXACEAE
- Podocarpus macrophyllus* D. Don
Podocarpus nagi Zoll. & Moritzi
- PINACEAE
- Juniperus conferta* Parl.
**Pinus luchuensis* Mayr
- PANDANACEAE
- Pandanus tectorius* Soland.
- GRAMINEAE
- Arundinaria linearis* Hack.
**Bambusa liukuensis* Hay.
Bambusa vulgaris var. *striata* Gamble
- PALMAE
- Didymosperma Engleri* Warb.
Livistona chinensis R. Br.
- LILIACEAE
- Smilax china* L.
**Smilax liukuensis* Hay.
**Smilax nervo-marginata* Hay.
**Smilax stenopetala* A. Gray
- PIPERACEAE
- Piper futokadsura* Sieb.
- MYRICACEAE
- Myrica rubra* S. & Z.
- FAGACEAE
- Castanopsis cuspidata* Schottky
Lithocarpus edulis Rehd.
**Quercus Miyagii* Koidz.
**Quercus yayeyamensis* Koidz.
- ULMACEAE
- **Celtis liukuensis* Nakai
- MORACEAE
- Broussonetia papyrifera* Vent.
Cudrania javanensis Trec.
Ficus Beecheyana Hook. & Arn.
Ficus erecta Thunb.
**Ficus Fachikoogi* Koidz.
- Ficus gibbosa* Bl.
Ficus leucantatoma Poir.
**Ficus Miyagii* Koidz.
Ficus pumila L.
Ficus retusa var. *nitida* Miq.
Ficus Thunbergii Maxim.
Ficus Wightiana Wall.
Ficus sp.
Morus alba L.
Morus bombycis Koidz.
- URTICACEAE
- Boehmeria densiflora* Hook. & Arn.
Boehmeria nivea Hook. & Arn.
Debregeasia edulis Wedd.
- LORANTHACEAE
- Loranthus yadoriki* Sieb.
Pseudixus japonicus Hay.
- OLACACEAE
- Schoepfia jasminodora* S. & Z.
- ARISTOLOCHIACEAE
- Aristolochia?* *Kaempferi* Willd.
- NYCTAGINACEAE
- Calpidia* sp.
- MAGNOLIACEAE
- **Illicium Tashiroi* Maxim.
Kadsura japonica Dunal
Michelia compressa Maxim
- TROCHODENDRACEAE
- Trochodendron aralioides* S. & Z.
- RANUNCULACEAE
- Clematis apiifolia* DC.
Clematis Benthiana Hemsl.
Clematis Meyeniana Walp.
Clematis paniculata Thunb.
Clematis Pierotii Miq.
**Clematis Tashiroi* Maxim.
- LARDIZABALACEAE
- Stauntonia hexaphylla* Decne.
- BERBERIDACEAE
- Nandina domestica* Thunb.

MENISPERMACEAE

- **Cissampelos insularis* Nakai
Cocculus laurifolius DC.
Stephania discolor Spreng.

LAURACEAE

- Actinodaphne lancifolia* Meisn.
 **Beilschmiedia Tanakae* Hay.
Benzoin citriodorum S. & Z.
Benzoin umbellatum var. *sericeum*
 Rehd.
Cassytha filiformis L.
 **Cinnamomum Doederleinii* Engl.
Cinnamomum Loureirii Nees
Cinnamomum pedunculatum Nees
Cinnamomum sericeum Sieb.
Litsea glauca Sieb.
Litsea japonica Juss.
Machilus longifolia Bl.
Machilus Thunbergii S. & Z.

HERNANDIACEAE

- Hernandia peltata* Meisn.

CAPPARIDACEAE

- Crataeva religiosa* Forst.

SAXIFRAGACEAE

- Deutzia crenata* S. & Z.
Deutzia scabra Thunb.
Hydrangea chinensis Maxim.
 **Hydrangea liukiensis* Nakai
Itea chinensis Hook. & Arn.
Pilostegia viburnoides var. *parviflora*
 Oliv.

PITTIOSPORACEAE

- Pittosporum glabratum* Lindl.
 **Pittosporum pauciflorum* Hook. & Arn.

HAMAMELIDACEAE

- **Distylium liukiensis* Nakai

ROSACEAE

- **Osteomeles subrotunda* C. Koch
Photinia Maximowiczii Decne.
Prunus macrophylla S. & Z.
Prunus spinulosa S. & Z.
 **Raphiolepis umbellata* var. *liukiensis*
 Koidz.
Rhodotypos tetrapetala Mak.
Rosa bracteata Wendl.
Rosa Luciae Fr. & Roch. var.
 **Rubus abortivus* O. Kuntze
 **Rubus bracteosus* A. Gray

- Rubus corchorifolius* var. *glaber* Matsum.
 **Rubus Grayanus* Maxim.
 **Rubus nesiotes* Focke
Rubus reflexus Ker-Gawl.
Rubus rosifolius var. *coronarius* f.
simpliciflorus Mak.
Rubus Sieboldii Bl.
Rubus tagallus Cham. & Schl.
Rubus triphyllus Thunb.

LEGUMINOSAE

- Acacia Farnesiana* Willd.
Acacia pennata Willd.
Æschynomene indica L.
Bauhinia japonica Maxim.
Bauhinia retusa Ham.
Caesalpinia Bonduc Roxb.
Caesalpinia Bonducella Flem.
Caesalpinia nuga Sit.
Caesalpinia pulcherrima Swartz
Canavalia obtusifolia DC.
Cassia occidentalis L.
Derris uliginosa Benth.
Desmodium Cephalotes Wall.
Desmodium laburnifolium DC.
Desmodium oxyphyllum DC.
Desmodium podocarpum DC.
Desmodium polycarpum DC.
Desmodium pulchellum Benth.
 **Desmodium Tashiroi* Matsum.
Desmodium triflorum DC.
Desmodium umbellatum DC.
Entada scandens Benth.
Erythrina indica Lam.
Euchresta Horsfieldii Benn.
Flemingia nana Roxb.
Flemingia stricta var. *pteropus* Baker
Indigofera hirsuta L.
 **Indigofera liukiensis* Mak.
Indigofera trifoliata L.
Indigofera trita L.
 **Intsia Tashiroi* Hayat.
Lespedeza striata Hook. & Arn.
Lespedeza virgata DC.
 **Maackia Tashiroi* Mak.
Milletia reticulata Benth.
Mucuna gigantea DC.
Ormocarpum glabrum Teijsm.
Ormocarpum sennoides DC.
Pongamia glabra Vent.
Pueraria hirsuta Matsum.
Rhynchosia minima DC.
Rhynchosia volubilis Lour.
Sophora tomentosa L.
Thermopsis chinensis Benth.

RUTACEAE

- **Citrus nobilis* var. *spontanea* Ito & Matsum.
Evodia meliaefolia Benth.
Evodia triphylla DC.
Glycosmis cochinchinensis Pierre
Murraya exotica L.
Skimmia japonica Thunb.
Toddalia asiatica Lam.
 **Zanthoxylum Arnottianum* Maxim.
 **Zanthoxylum Hemsleyana* Mak.
 **Zanthoxylum liukuense* Hay.
Zanthoxylum nitidum DC.
 **Zanthoxylum okinawense* Wils.¹

SIMARUBIACEAE

- Picrasma quassioides* Benn.

MELIACEAE

- Aglaia odorata* Lour.
Melia Azedarach L.

MALPIGHIACEAE

- Tristellateia australis* A. Rich.

EUPHORBIACEAE

- Alchornea trewioides* Muell. Arg.
Antidesma japonica S. & Z.
Bischofia javanica Bl.
Breynia rhamnoides Muell. Arg.
Cleidion ulmifolium Muell. Arg.
Croton Cumingii Muell. Arg.
Daphniphyllum glaucescens Bl.
Daphniphyllum macropodum Miq.
Excoecaria Agallocha L.
Excoecaria japonica Muell. Arg.
Glochidion Arnottianum Muell. Arg.
Glochidion bicolor Hay.
Glochidion obovatum S. & Z.
Glochidion zeylanicum A. Juss.
Homonoya riparia Lour.
Macaranga Tanarius Muell. Arg.
Mallotus philippinensis Muell. Arg.
 **Phyllanthus liukuensis* Matsum.
Phyllanthus Urinaria L.
 **Putranjiva Matsumurae* Koidz.
Securinega fluggeoides Muell. Arg.

BUXACEAE

- **Buxus liukuensis* Mak.

ANACARDIACEAE

- Rhus succedanea* L.

AQUIFOLIACEAE

- Ilex cinerea* Champ.
 **Ilex Hanceana* f. *rotundata* Mak.
Ilex integra Thunb.
 **Ilex liukuensis* Loes.
 **Ilex Maximowiczii* Loes.
 **Ilex mutchagara* Mak.
Ilex rotunda Thunb.
 **Ilex Warburgii* Loes.
Ilex sp.

CELASTRACEAE

- Celastrus articulatus* Thunb.
Evonymus japonicus Thunb.
 **Evonymus lutchuensis* Ito
 **Evonymus Tanakae* Maxim.
 **Evonymus Tashiroi* Maxim.
Gymnosporia diversifolia Maxim.
Otherodendron japonicum Mak.

STAPHYLACEAE

- Euscaphis japonica* Pax
Turpinia nepalensis Wall.

ICACINACEAE

- Mappia ovata* var. *insularis* Matsum.

ACERACEAE

- Acer acuminatum* Wall.
 **Acer insulare* Mak.
Acer oblongum var. *microcarpum*
 Hiern

SAPINDACEAE

- Dodonaea viscosa* Jacq.
Sapindus mukorossi Gaertn.

SABIACEAE

- **Meliosma lutchuensis* Koidz.
Meliosma Oldhamii Miq.
Meliosma rigida S. & Z.

RHAMNACEAE

- Berchemia lineata* DC.
Colubrina asiatica Brong.
Rhamnella franguloides Weber

¹ *Zanthoxylum okinawense* Wilson, n. comb. — *Fagara schinifolia* Ito & Matsumura in Jour. Coll. Sci. Tokyo, XII. 356 (Tent. Fl. Luchu. 89) (1900), pro parte, non Engler. — *Fagara okinawensis* Nakai in Tokyo Bot. Mag. XXVIII. 306 (1914).

LIUKIU ISLANDS: Okinawa and Oshima.

**Rhamnus davuricus* var. *liukuensis*
Wils.¹

**Rhamnus Kanagusukii* Mak.
Sageretia theezans Brongn.

VITACEAE

Ampelopsis brevipedunculata Koehne
Cissus corniculata Planch.
Tetrastigma angustifolia Planch.
Vitis formosana Hemsl.
Vitis lanata Roxb.
Vitis Thunbergii S. & Z.

ELAEOCARPACEAE

Elaeocarpus ellipticus Mak.
Elaeocarpus japonicus S. & Z.

TILIACEAE

Triumfetta procumbens Forst.
Triumfetta rhomboidea Jacq.

MALVACEAE

Abutilon Abemoschus L.
Abutilon indicum G. Don
Hibiscus mutabilis L.
Hibiscus rosa-sinensis L.
Hibiscus syriacus L.
Hibiscus tiliaceus L.
Hibiscus tiliaceus var. *hamabo* Maxim.
Sida rhombifolia L.
Thespesia populnea Soland.
Urena lobata L.
Urena sinuata L.

STERCULIACEAE

Firmiana simplex Wight
Helicteres angustifolia L.

Heritiera littoralis Dryand.
Melochia corchorifolia L.

DILLENACEAE

Actinidia callosa var. *rufa* Mak.
Actinidia melanandra Fr.

THEACEAE

Adinandra Millettii Benth.
Eurya emarginata Mak.
Eurya japonica Thunb.
Eurya ochracea Szyszyl.
Eurya symplocina Bl.
**Schima liukuensis* Nakai
Ternstroemia japonica Thunb.
Thea japonica Nois.
**Thea lutchuensis* Ito
**Thea Miyagii* Koidz.
**Thea tegmentosa* Koidz.
**Thea virgata* Koidz.

GUTTIFERAE

Calophyllum inophyllum L.
Garcinia spicata Hook.
Hypericum patulum Thunb.

FLACOURTIACEAE

Idesia polycarpa Maxim.

STACHYURACEAE

Stachyurus lancifolius Koidz.

THYMELAEACEAE

**Wikstroemia retusa* A. Gray

ELAEAGNACEAE

**Elaeagnus liukuensis* Rehd.²
Elaeagnus macrophylla Thunb.

¹ *Rhamnus davuricus* var. *liukuensis* Wilson, var. nov.

A typo recedit foliis majoribus magis chartaceis grossius crenato-serratis glaberrimis nunquam latioribus supra medium, perulis gemmarum ut videtur numerosioribus.

LIUKIU ISLANDS: Okinawa Island, sea-coast, February 28, 1917, *E. H. Wilson* (No. 8003, type; bush 2-3 in. tall; flowers greenish); Naha, Onoyama, common, May 1, 1917, *E. H. Wilson* (No. 8157; bush 2-3 in. tall).

Quite likely this Liukiu plant is a distinct species, but I have specimens bearing male flowers and adult leaves only. On the coast near Naha it is quite a common shrub.

E. H. W.

² *Elaeagnus liukuensis* Rehder, sp. nov.

Frutex sarmentosus, 3-4-metralis, ramis elongatis non spinescentibus sub angulo circiter 45° divergentibus. Folia perennia, chartacea, ovato-elliptica vel elliptica, apice acutiuscula vel subito breviter acuminata, basi rotundata, 4-7 cm. longa et 2.5-3.8 cm. lata, margine leviter revoluta vel fere plana, initio utrinque squamis plerisque ferrugineis oblecta, maturitate supra glabra, nitidula, intense luteo-viridia, subtus fulvescentia vel fere argentea, ad costam pleraque ferruginea, utrinsecus nervis secundariis 5-7 supra in sicco et subtus leviter elevatis, reti nervulorum utrinque obsoleto; petioli supra canaliculati, ferruginei, 0.5-1 cm. longi. Flores solitarii, nutantes, 2-6 in ramulis brevibus primo vere vel antea in axillis foliorum evoluti; pedicelli graciles, 0.6-1 cm. longi, ferruginei ut perigonii pars inferior; perigonii pars

LYTHRACEAE

Lagerstroemia subscostata var. *hirtella*
Koehne

SONNERATIACEAE

Sonneratia alba Smith

LECYTHIDACEAE

Barringtonia racemosa Roxb.
Barringtonia speciosa Forst.

RHIZOPHORACEAE

Bruguiera gymnorrhiza Lam.
Kandelia Rheedii Wight & Arn.
Rhizophora mucronata Lam.

ALANGIACEAE

Alangium chinense Rehd.

COMBRETACEAE

Lumnitzera racemosa Willd.
Terminalia Catappa L.

MYRTACEAE

Eugenia Jambos L.
Eugenia microphylla Abel
Psidium Guyava var. *pyriferum* Ruthie
Rhodomyrtus tomentosa Wight

MELASTOMACEAE

Blastus cochinchinensis Lour.
Bredia hirsuta Bl.
Melastoma candidum Don
Osbeckia chinensis L.
**Tashiroea okinawensis* Matsum.
**Tashiroea yaeyamensis* Matsum.

ARALIACEAE

Acanthopanax ricinifolius Seem.
Fatsia japonica Decne.

Gilibertia trifida Mak.
Hedera japonica Tobl.
Schefflera octophylla Harms
Tetrapanax papyrifera C. Koch

ERICACEAE

**Rhododendron ellipticum* Maxim.
Rhododendron serphyllifolium Miq.
**Rhododendron sublanceolatum* Miq.
Rhododendron Tashiroi Maxim.
Vaccinium? *Donianum* Clark.
Vaccinium bracteatum var. *Wrightii*
Rehd. & Wils.

MYRSINACEAE

Ardisia Sieboldii Miq.
Maesa formosana Mez
Rapanea neriifolia Mez

PLUMBAGINACEAE

Statice Wrightii Hance

SAPOTACEAE

Sideroxylon? *ferrugineum* Hook. & Arn.

EBENACEAE

**Diospyros liukiensis* Mak.
Maba buxifolia Pers.

SYMPLOCACEAE

Symplocas caudata Wall. var.
**Symplocos japonica* var. *Nakaharai*
Hay.
Symplocos lancifolia S. & Z.
Symplocos lucida S. & Z.
**Symplocos microcalyx* Hay.
Symplocos neriifolia S. & Z.
**Symplocos okinawensis* Matsum.
Symplocos spicata Roxb.
**Symplocos Tanakae* Matsum.
**Symplocos Tashiroi* Matsum.

superior tubuloso-campanulata, basi subito constricta, 6 mm. longa, intus glaber ut pars inferior, extus squamis argenteis rufescentibus intermixtis oblecta ut lobi late ovati, acuti, 4 mm. longi, intus stellato-pilosi; antherae oblongae, lobos dimidios non superantes, filamentis 0.75 mm. longis medio affixae; stylus antheras medias vix superans, pilis stellatis perpaucis munitus, stigmatum leviter curvato; discus inconspicuus. Fructus non visi.

LIUKIU ISLANDS: Okinawa Island, common round Naha, March 1, 1917, *E. H. Wilson* (No. 8159).

This species seems to be most closely related to *E. Henryi* Warburg and *E. sarmentosa* Rehder, which both are readily distinguished by the narrower acuminate leaves and the longer perigon. The Japanese botanists seem to have confused it with *E. glabra* Thunberg, as the latter is credited to the Liukiu Islands by Nakai (in *Tokyo Bot. Mag.* xxx. 74 [1916]), but that species differs chiefly in the longer perigon slightly constricted and the upper part gradually narrowed, in the shorter pedicels and the acuminate leaves. *Elaeagnus rotunda* a Nakai from the Bonin Islands which is somewhat similar in the shape of its leaves, is easily distinguished by its slender and longer petioles, more or less persistent scales on the upper surface of the leaves, by their often broadly cuneate base and by the short pedicels. A. R.

STYRACACEAE

Styrax formosanus Matsum.

OLEACEAE

Fraxinus insularis Hemsl.

**Fraxinus minute-punctata* Hayat.

**Jasminum superfluum* Koidz.

Ligustrum japonicum Thunb.

**Ligustrum liukiense* Koidz.

**Osmanthus bracteatus* Matsum.

LOGANIACEAE

Buddleia curviflora Hook. & Arn.

APOCYNACEAE

Alstonia scholaris R. Br.

Anodendron laeve Maxim.

Cerbera odollam Gaertn.

Hoya carnosa R. Br.

Marsdenia tinctoria R. Br.

Marsdenia tomentosa Morr.

**Stephanotis lutchuensis* Koidz.

Trachelospermum divaricatum var.
brevisepalum Schneid.

Tylophora japonica Miq.

**Tylophora liukiensis* Matsum.

**Tylophora stenoloba* Warb.

CONVOLVULACEAE

Erycibe obtusifolia Benth.

Ipomaea biloba L.

BORAGINACEAE

Ehretia acuminata R. Br.

**Ehretia ovalifolia* var. *liukiensis* Matsum.

Tournefortia argentea L.

VERBENACEAE

**Callicarpa australis* Koidz.

Callicarpa mollis S. & Z.

**Callicarpa oshimensis* Hay.

Clerodendron fragrans Vent.

Clerodendron inerme Gaertn.

Clerodendron japonicum Mak.

Clerodendron trichotomum Thunb.

Lantana camara L.

Premna integrifolia L.

Vitex Negundo L.

Vitex ovata Thunb.

SOLANACEAE

Solanum verbascifolium L.

MYOPORACEAE

Myoporum bontioides A. Gray

RUBIACEAE

Adina racemosa Miq.

Chomelia corymbosa K. Schum.

Damnacanthus indicus var. *genuinus*
Mak.

Gardenea augusta Merr.

Ixora chinensis Lam.

**Lasianthus Tashiroi* var. *pubescens*
Matsum.

Morinda umbellata L.

Mussaenda parviflora Miq.

Paederia tomentosa Bl.

Psychotria elliptica Ker-Gawl.

Psychotria serpens L.

Randia canthioides Champ.

Serissa foetida Comm.

**Tetraplasia biflora* Rehd.¹

Thysanospermum diffusum Champ.

Tricalysia viridiflora DC.

Wendlandia glabrata DC.

CAPRIFOLIACEAE

**Lonicera japonica* var. *Miyagusukiana*
Mak.

Sambucus formosana Nakai

Viburnum japonicum Spreng.

Viburnum odoratissimum Ker.

**Viburnum suspensum* Lindl.

GOODENIACEAE

Scaevola Koenigii Vahl.

APPENDIX

LIST OF WOODY PLANTS OF THE KAWANABE ISLANDS

COMPILED BY MR. USHIWO

The Kawanabe or Tokara Islands are situated between Lat. 28° 30' and 30° 10' N., and Long. 129° to 130° E. They are eleven in number and stretch from south of the islands of Yaku and Tanega lying south of Japan nearly to Oshima. All are small in size and are composed of coral and volcanic rock and are windswept and

¹ See p. 190.

very difficult of access. None of them rise more than a few hundred feet above sea-level. Three are treeless and uninhabited; on the others a few fishermen live. In 1914 I visited Yaku-shima where *Pinus Thunbergii* Parl. is indigenous and in 1917 Oshima where *Pinus lutchuensis* Mayr grows. In relation to the geographical distribution of these two Pines it seems desirable to know what species grew on the intervening Kawanabe Islands.

On my return to Kago-shima from the Liukiu Islands in March, 1917, I discussed the matter with Dr. Naito, chief of the local forestry bureau, to whom I was greatly indebted for valuable assistance in 1914 and again in 1917. Dr. Naito shared my view on the importance of this subject and detailed one of his assistants to make a tour of the islands and to collect all the Conifers he found there. Mr. Ushiwo, who had been my companion to the Liukiu Islands, was selected for the task and he most successfully carried it out. He visited the principal six of the eleven islands. Of the other five, three he states are treeless and on the other two he was unable to land. The tides and currents are very strong and it is only at certain seasons that fishing boats can make a landing. Mr. Ushiwo collected specimens and compiled a list of all the woody plants found on the six islands he visited. The list is phytogeographically of much importance and is here published as an appendix to the preceding account of the Liukiu Islands. The Conifers were sent to me for determination and it is interesting to note that the only Pine that grows there is *Pinus luchuensis* Mayr.

Mr. Ushiwo in his list enumerates 114 species and 13 varieties belonging to 93 genera of 53 families. Of these *Rhododendron indicum* var. *eriocarpum* Hay. appears to be endemic. If comparison be made with my list of Liukiu plants it will be seen that the woody vegetation of the Kawanabe Islands is essentially the same as that of the Liukiu Islands. It appears that on Yaku-shima and Tanega-shima most of the typical woody plants of Japan reach their southern limit.

E. H. WILSON

CYCADACEAE

Cycas revoluta Thunb.

TAXACEAE

Podocarpus macrophyllus D. Don

Podocarpus nagi Zoll. & Moritzi

PINACEAE

Juniperus conferta Parl.

Pinus luchuensis Mayr

PANDANACEAE

Pandanus tectorius Soland.

GRAMINEAE

Arundinaria linearis Hack.

Arundinaria tootsik Mak.

PALMAE

Didymosperma Engleri Warb.

Livistona chinensis R. Br.

LILIACEAE

Smilax china L.

MYRICACEAE

Myrica rubra S. & Z.

SALICACEAE

Salix purpurea L.?

BETULACEAE

Alnus firma var. *hirtella* Schneid.

FAGACEAE

Castanopsis cuspidata Schottky

Castanopsis edulis Mak.

Quercus glauca Thunb.

ULMACEAE

Celtis sinensis var. *japonica* Nak.

Trema orientalis Planch.

MORACEAE

Ficus erecta Thunb.

Ficus nervosa Heyne

Ficus pumila L.

Ficus retusa var. *nitida* Miq.

Ficus Wightiana Benth.

Morus bombycis Koidz.

NYCTAGINACEAE

Calpidia sp.

LORANTHACEAE

Loranthus yadoriki Sieb.
Pseudixus japonicus Hay.

MAGNOLIACEAE

Illicium anisatum L.
Kadsura japonica Dunal

LARDIZABALACEAE

Stauntonia hexaphylla Decne.

LAURACEAE

Actinodaphne acuminata Meisn.
Benzoin citriodorum S. & Z.
Cinnamomum pedunculatum Nees
Cinnamomum sericeum Nees
Litsea glauca Sieb.
Litsea japonica Juss.
Machilus longifolia Bl.
Machilus Thunbergii S. & Z.

CAPPARIDACEAE

Crataeva religiosa Forst.

SAXIFRAGACEAE

Deutzia crenata Thunb.
Deutzia gracilis S. & Z.
Hydrangea chinensis Maxim.
Hydrangea paniculata Sieb.

PITTOSPORACEAE

Pittosporum tobira Ait.

ROSACEAE

Prunus serrulata f. spontanea Wils.
Raphiolepis umbellata Mak.
Raphiolepis umbellata var. liukuensis
Koidz.
Rubus rosaefolius Smith
Rubus triphyllus Thunb.

LEGUMINOSAE

Albizzia Julibrissin Durraz.
Maackia Tashiroi Mak.

RUTACEAE

Evodia meliaefolia Benth
Zanthoxylum ailanthoides S. & Z.
Zanthoxylum piperitum DC.
Zanthoxylum schinifolium S. & Z.

MELIACEAE

Melia Azedarach L. (planted)

EUPHORBIACEAE

Daphniphyllum glaucescens Bl.
Daphniphyllum macropodum Miq.
Gelonium aequoreum Hance
Glochidion honkongense Muell. Arg.
Glochidion odoratum S. & Z.
Mallotus japonicus Muell. Arg.
Phyllanthus flexuosus Muell. Arg.

ANACARDIACEAE

Rhus succedanea L.

AQUIFOLIACEAE

Ilex crenata var. Fukasawana Mak.
Ilex integra Thunb.
Ilex rotunda Thunb.

CELASTRACEAE

Celastrus articulatus var. punctata Mak.
Evonymus japonicus Thunb.
Evonymus sp.
Evonymus Tanakae Maxim.
Otherodendron japonicum Mak.

STAPHYLEACEAE

Euscaphis japonica Pax
Turpinia nepalensis Wall.

SABIACEAE

Meliosma myriantha S. & Z.

ELAEOCARPACEAE

Elaeocarpus ellipticus Mak.
Elaeocarpus japonicus S. & Z.

MALVACEAE

Hibiscus mutabilis L.
Hibiscus tiliaceus var. hamabo Maxim.

THEACEAE

Eurya emarginata Mak.
Eurya japonica Thunb.
Eurya ochnacea Szysz.
Ternstroemia japonica Thunb.
Thea japonica var. spontanea Mak.

STACHYURACEAE

Stachyurus lancifolius Koidz.

FLACOURTIACEAE

Idesia polycarpa Maxim.

ELAEAGNACEAE

- Elaeagnus glabra* Thunb.
Elaeagnus macrophylla Thunb.

THYMELAEACEAE

- Daphne cannabina* Wall.

ARALIACEAE

- Aralia chinensis* var. *glabrescens* L.
Fatsia japonica Decne. & Planch.
Gilibertia trifida Mak.
Schefflera octophylla Harms.

CORNACEAE

- Aucuba japonica* Thunb.

ERICACEAE

- Rhododendron indicum* var. *eriocarpum*
 Hay.
Rhododendron Tashiroi Maxim.
Vaccinium bracteatum Thunb.

MYRSINACEAE

- Ardisia crispa* DC.
Ardisia hortorum Maxim.
Ardisia Sieboldii Miq.
Maesa japonica var. *latifolia* Miq.
Myrsine neriifolia Mez.

SAPOTACEAE

- Sideroxylon ferrugineum* Hook. & Arn.

SYMPLOCACEAE

- Symplocos caudata* Wall.
Symplocos lucida S. & Z.
Symplocos neriifolia S. & Z.

STYRACACEAE

- Styrax japonicus* S. & Z.

OLEACEAE

- Fraxinus insularis* Hemsl.
Ligustrum japonicum S. & Z.
Ligustrum sp.
Osmanthus bracteatus Matsum.

APOCYNACEAE

- Trachelospermum divaricatum* K.
 Schum.

VERBENACEAE

- Callicarpa japonica* Thunb.
Clerodendron trichotomum Thunb.
Vitex ovata Thunb.
Vitex trifoliolata L.

BORAGINACEAE

- Tournefortia argentea* L. f.

RUBIACEAE

- Damnacanthus indicus* var. *genuinus*
 Mak.
Gardenia augusta Merr.
Lasianthus japonicus Miq.
Mussaenda parviflora Miq.
Psychotria elliptica Ker-Gawl.

CAPRIFOLIACEAE

- Lonicera affinis* var. *pubescens* Maxim.
Viburnum japonicum Spr.
Viburnum odoratissimum Ker-Gawl.

GOODENIACEAE

- Scaevola Koenigii* Vahl

FOUR NEW CONIFERS FROM KOREA

E. H. WILSON

Thuja koraiensis Nakai in Tokyo Bot. Mag. xxxiii. November (1919).
 — *Thuja japonica* Komarov in Act. Hort. Petrop. xx. 206 (Pl. Mandsh. i.) (1901), non Maximowicz. — Nakai, Veget. Mt. Waigolbon, 32 (1916).
 — *Thuja Standishii* Nakai in Jour. Coll. Sci. Tokyo, xxxi. 382 (Fl. Kor. ii.) (1911), non Carrière. — *Thuja odorata* Doi in Tokyo Bot. Mag. xxix. [422] (1915), nom. nudum, non Marshall. — *Thuja kongoensis*¹ Doi apud Nakai, Rep. Veget. Diamond Mts. 163 (1918), nom. nudum.

¹ Such a specific name derived from Kongo-san or Diamond Mountains in Korea is apt to mislead people into assuming that the plant is from the Congo (Kongo) region in Africa; to avoid this contingency I suggested to Dr. Nakai that it be rejected.